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(पहला पुनरीक्षण)

Indian Standard

CONVEYORS — SCRAPER (FLIGHT) — GENERAL REQUIREMENTS

(First Revision)

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November 1994 **Price Group 5**

Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee, HMD 6

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Continuous Bulk Conveying, Elevating, Hoisting, Aerial Ropeways and Related Equipment Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard was first published in 1977. In this revision, the scope of the standard has been enlarged to cover a large family of scraper conveyors. In addition, requirements for chains, sprockets and flights have been modified.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CONVEYORS — SCRAPER (FLIGHT) — GENERAL REQUIREMENTS

(First Revision)

1 SCOPE

1.1 This standard lays down the requirements for scraper conveyors also known as flight conveyors.

1.1.1 This standard also covers the requirements for scraper conveyors for handling dry baggasse.

1.1.2 This standard does not cover the requirements for portable scraper (flight) conveyors of any sort and is also not applicable to conveyors handling material which are brittle, moist, sticky and do not behave as a solid.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
4240 : 1984	Glossary of conveyors terms and definitions (*first revision*)
6834 (Part 1) : 1973	Conveyor chain, chain wheels and attachments: Part 1 Chains
6834 (Part 2) : 1976	Conveyor chain, chain wheels and attachments: Part 2 Chainwheels
12919 : 1990	Conveyor chains for cane sugar industry
12959 : 1991	Technical supply requirements for sprocket wheels for link chains

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in IS 4240 : 1984 along with the following shall apply.

3.1 Length

The length of the conveyor is the total length from the axis of the head-end sprocket to the axis of the tail-end sprocket with all adjustable sections adjusted to their shortest length measured along the path of the conveyor.

3.2 Trough Width

The principal characteristic of a flight conveyor is the width of flights of a flight chain (or in some cases the width of the trough) and in case of tubular flight conveyor (with standard tubes), the outside diameter of the tube.

4 TYPE AND USAGE

4.0 The shape and height of flights are the principal, features by which flight conveyors are divided into design types. These types, in general, may be classified as:

a) High solid flight coveyors,

b) Low solid flight conveyors, and

c) Tubular flight conveyors.

These conveyors are used for conveying dusty, gas evolving or hot goods also.

4.1 High Solid Flight Conveyor

In this type of conveyor, flight height is roughly equal to the depth of the trough and more than several times the height of the links of the hauling chain. The trough is open type mounted on a support structure. A vertically closed hauling chain with flights attached to it, moving in the trough, is bent around the terminal sprockets. The material to be conveyed is poured into the trough at any point along its length and pushed by the flight along the trough. Unloading can be performed at any point along the trough openings which are provided in its bottom. These conveyors are generally of four types used for different operating conditions.

4.1.1 *Single Strand Conveyor Where Chain is Supported only by Scraper Plates*

In these types of conveyors, chain is supported along the track and material is transported in bottom trough only. During erection, a gap is maintained between trough and flight so that wear of flight is eliminated. These conveyors are used for light duty and short centre conveyor. These conveyors are designed for sliding directly on a steel trough. They are suitable for narrow flights carrying free flowing material with lumps not larger than 100 mm in one direction only (*see* Fig. 1).

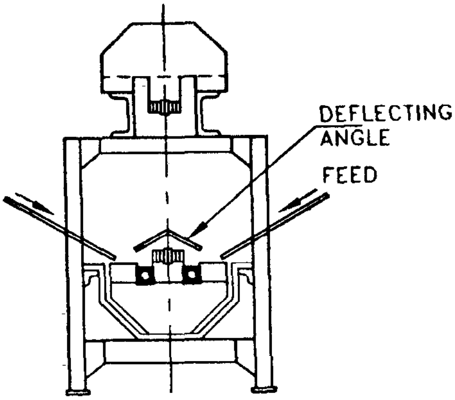


FIG. 1 SINGLE STRAND CONVEYOR WHERE CHAIN IS SUPPORTED ONLY BY SCRAPER PLATES

4.1.2 *Single Strand Conveyor with Shoe Suspended Flights*

These conveyors are used for long distances and high capacity. This type of conveyor is used where several feed and discharge points are required. The conveyors may have chains of either roller design or drag link design (*see* Fig. 2).

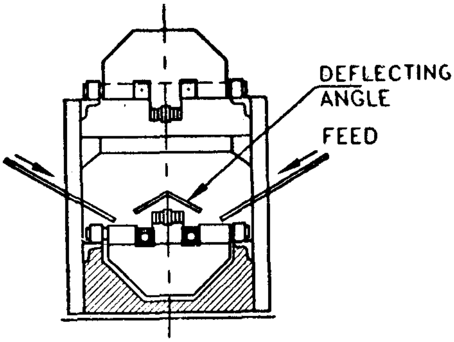


FIG. 2 SINGLE STRAND CONVEYOR WITH SHOE SUSPENDED FLIGHTS

4.1.3 *Double Strand Conveyor with Plain or Roller Chain Suspended Flights*

These conveyors consist of steel flights attached to double strands of rivetless or roller type chain. The chain operates on flat renewable steel base attached to the trough. These conveyors are used for large capacities and for longer path than the single strand flight conveyors. These are suitable for wide flights carrying material containing longer lumps up to 400 mm in size. These are used to handle material on the bottom run only (*see* Fig. 3).

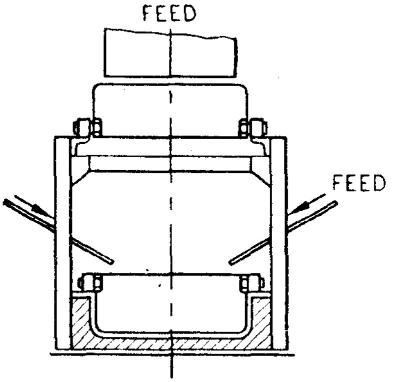


FIG. 3 DOUBLE STRAND CONVEYOR WITH PLAIN OR ROLLER CHAIN SUSPENDED FLIGHTS

4.1.4 *Double Strand Conveyor with Plain or Roller Chain Suspended Double Depth Style Flights*

These conveyors are similar to **4.1.3** except that they are designed to carry material containing longer lumps on both upper and lower run. Pivoted type flights with respect to chain at either end facilitate any misalignment and non-uniform elongation of chain strands at either end of flight. It may be used for wider conveyors (*see* Fig. 4).

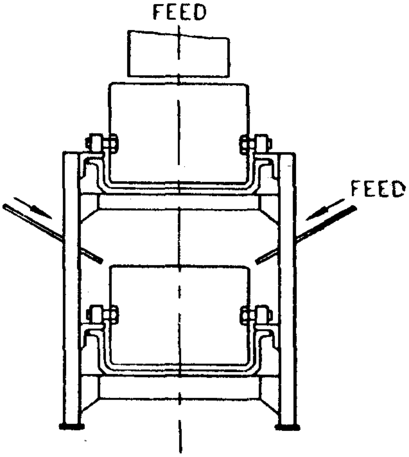


FIG. 4 DOUBLE STRAND CONVEYOR WITH PLAIN OR ROLLER CHAIN SUSPENDED DOUBLE DEPTH STYLE FLIGHTS

4.2 Low Solid Flight Conveyors

In this type of conveyor, the height of low flights is commensurable with that of chain links and is only a small fraction of the depth of the trough. This has closed frame whose bottom portion forms a trough for the movement of the load. The hauling chain with flights passes inside the frame and bend around terminal sprocket. The lower run of the conveyor slides on the trough bottom and moves the load. The return run moves in the upper portion of the frame on guide tracks, support roller or a continuous floor. The load can be poured at any point of the horizontal trough and is moved by the chain and flights in continuous layer whose height in horizontal section exceed substantially two to six times depending on the properties of the material. Underground coal conveyors widely employed in collieries relate to the group of conveyors with low flights, but differ substantially from these conveyors.

4.2.1 *Conveyors with Single Chain in Horizontal Condition*

These conveyors are used to transport pulverized, granular and small sized lumpy material in horizontal direction in particular of hot goods with temperatures up to 700°C. The chain used are of special clevis type chain. If necessary, horizontal turn may also be provided in conveyor layout by suitably modifying the design of the chain (*see* Fig. 5).

4.2.2 *Conveyors with Double Chain with Flights of Increased Height*

These conveyors are used for higher capacities and longer lengths (*see* Fig. 6).

4.2.3 *Conveyors with Single Chain Used in Inclined Condition*

These conveyors are used to transport material in planes inclined up to 15°C for conveying grains, grain products in grain elevators and grain and fodder mills (*see* Fig. 7).

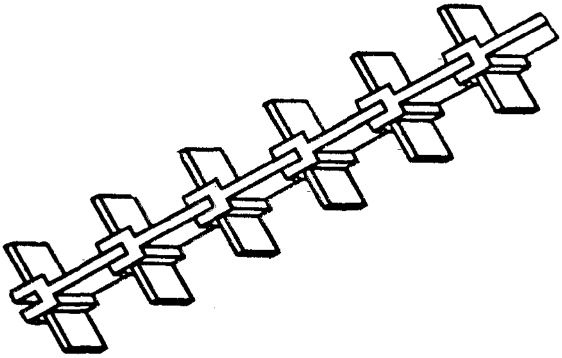


Fig. 5 Single Chain Conveyor in Horizontal Condition

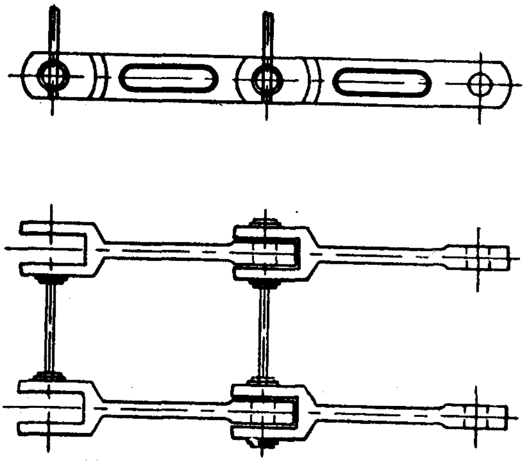


Fig. 6 Double Chain Conveyor with Flights of Increased Height

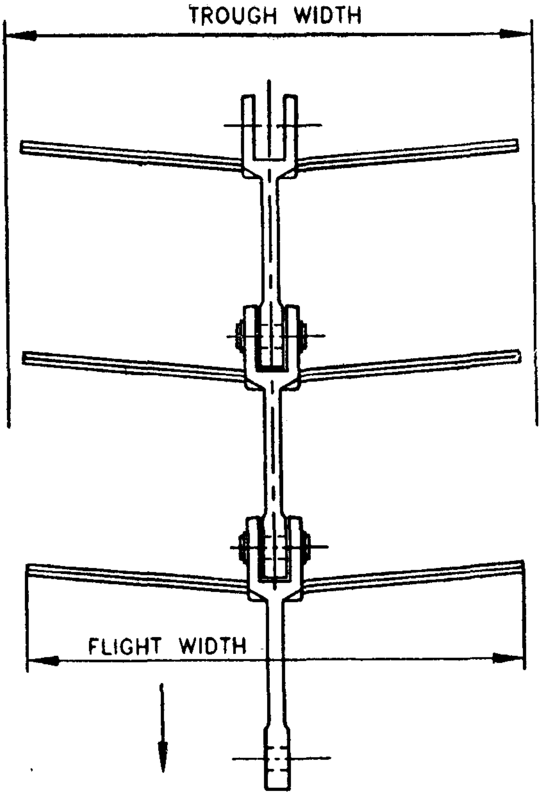


FIG. 7 SINGLE CHAIN CONVEYOR, USED IN INCLINED CONDITION

4.3 Tubular Flight Conveyors

A tubular flight conveyor has a hauling chain with round or rectangular flights fastened to it. The chain moves along a continuous closed contour inside a hermetic tube of a circular or rectangular cross section so that the load is moved in the tube in a continuous flow (*see* Fig. 8).

5 CONSTRUCTIONAL FEATURES

Conveyors with flexible tractive elements have flights, hauling chain, sprocket for hauling chain, conveyor beds, troughs, take up devices, conveyor drives as main components to ensure reliable and efficient operation of a conveyor. Its tractive elements should possess appropriate so as to bend freely around pulleys or sprockets of small diameters. The construction of the different elements shall be as follows.

5.1 Flights

5.1.1 The flights of flight conveyors have trapezoidal, semicircular or rectangular shape. Doubled rectangular flights are used in conveyors with two working runs. Flights are made

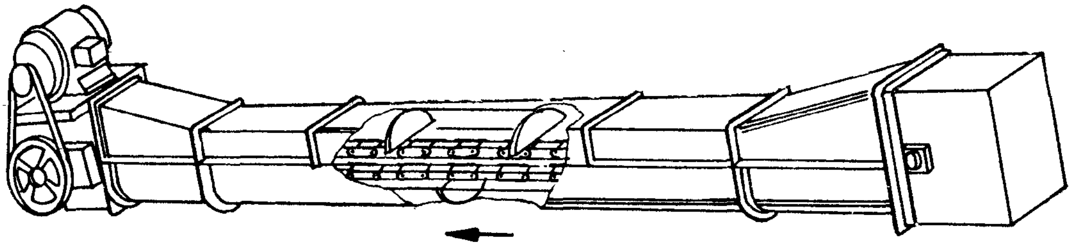
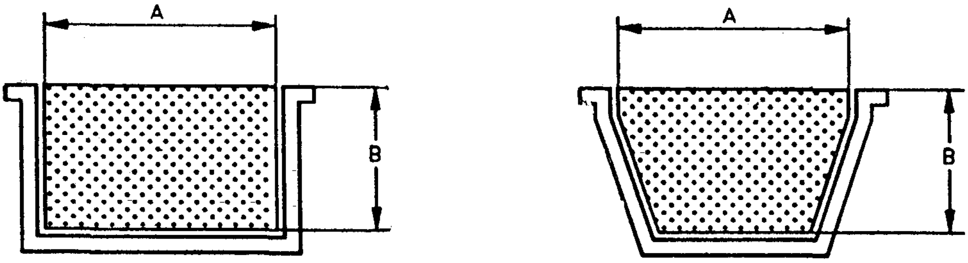


FIG. 8 SCHEMATIC ARRANGEMENT FOR TUBULAR FLIGHT CONVEYORS

from steel sheets, 3 to 8 mm thick, with stamped ribs to increase their rigidity. Plastic (Nylon) semicircular flights of a small rib are also used in flight conveyors. Flights shown in Fig. 9, 10, 11 and 12 are generally used in high solid flight conveyors.

5.1.2 For low solid flight conveyors, the flights are made from flat or profiled steel plates. In single chain conveyors, the flights are welded to chain links perpendicularly or at an angle of 85° relative to the longitudinal axis. In double chain conveyors, they are fastened to chain



STYLE A

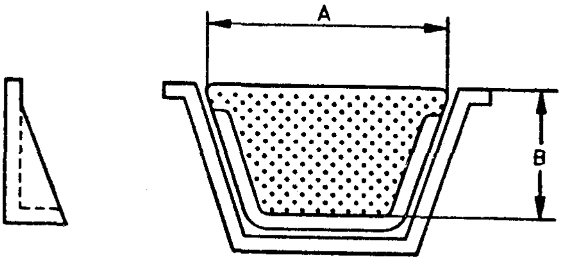
STYLE B1

Steel, Plain	Length *A*	300	300	375	450	375	450	600	600	750
	Width *B*	100	150	150	150	200	200	200	250	250

Steel with Sliding Shoe	Length *A*	300	300	375	450	375	450
	Width *B*	100	150	150	150	200	200

All dimensions in millimetres.

FIG. 9 DIMENSIONS OF FLIGHTS OF STYLE A AND B1

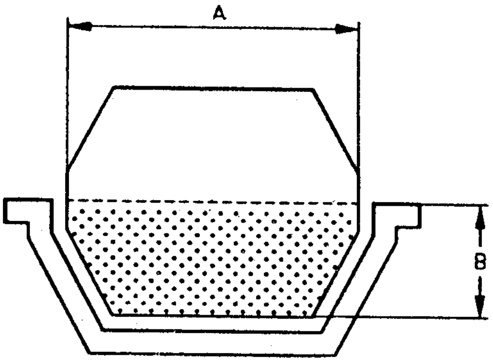


STYLE B2

Length *A*	300	300	375
Width *B*	100	150	150

All dimensions in millimetres.

FIG. 10 DIMENSIONS OF FLIGHTS OF STYLE B2

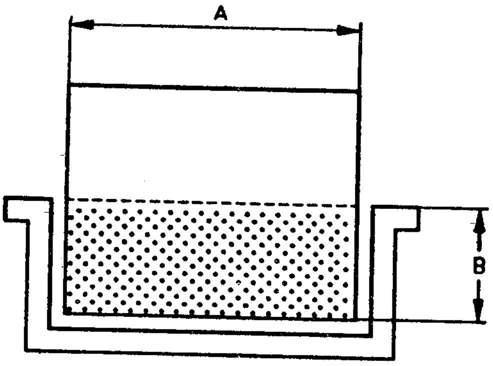


STYLE C

Length *A*	300	300	375	450	375	450	600	600	750
Width *B*	200	300	300	300	400	400	400	500	500

All dimensions in millimetres.

FIG. 11 DIMENSIONS OF FLIGHT OF STYLE C



STYLE D

Length *A*	300	300	375	450	375	450	600	600	750	1 000	1 300
Width *B*	200	300	300	300	400	400	400	500	500	300	350

All dimensions in millimetres.

FIG. 12 DIMENSIONS OF FLIGHT OF STYLE D

links by means of thick split pin. In horizontal and steeply sloped conveyors, the height of flights is equal to or smaller than the height of the chain. In slightly inclined conveyors, the flights are higher than the chain.

5.1.3 Flights of a tubular conveyors are made of steel, iron, plastic or rubber and have a thickness of 10 to 20 mm. Combined flights are known in which the central portion is made of steel or iron and the periphery is clad by rubber or plastic.

5.1.4 The frictional force and wear and tear between flight, trough and material may be reduced through use of flights manufactured from PTFE or UNMWHDPE or PVDF in certain cases. Flights may have thickness of 10 mm to 20 mm. The design of the flight shall be such as to avoid bending failure.

5.2 Hauling Chains

5.2.1 The main characteristics of a hauling chain are the chain pitch, that is, the spacing between the centers of chain pins, the ultimate strength and the mass per unit length of the chain.

5.2.2 Laminated wheel chains are generally used for high solid flight and low solid flight conveyors. The chains of round link or special clevis type chains shall conform to relevant Indian Standards. The standard pitch for clevis type chains are generally 100, 125, 160 200 or 250 mm. The diameter of the pin varies from 16 to 40 mm. The breaking load of chain is normally kept between 160 M and 1 000 M. These chains are made of steel C35, C45 or C50 with heat treatment.

5.2.3 The hauling chains of scraper conveyors shall conform to IS 6834 (Part 1) : 1973 or IS 12919 : 1990. Chains of other designs may also be used provided the requirements specified in these standards are generally followed.

5.3 Sprockets

5.3.1 The tooth profile of a sprocket for laminated sleeve type roller and wheel chain and round link chain shall be made according to available Indian Standards. The sprockets shall be cast from steel C35, C40 or C50. Teeth of sprocket are formed by milling and then hardened by induction hardening process to a hardness of 50 to 54 HRC.

5.3.2 The tooth profile of sprocket for double hinged clevis type chain is constructed by the same method as for wheel chain. A sprocket for double hinged chain consists of two parallel toothed discs. The tooth of one disc engages the right hand wheels and those of the other, the left hand discs to accommodate the horizontal wheels (*see* Fig. 13).

5.3.3 Sprockets for scraper conveyors shall conform to either IS 6834 (Part 2) : 1976 or IS 12959 : 1991. Sprockets of other designs may also be used provided the requirements specified in these specifications are generally followed.

5.4 Take Up

5.4.1 Irrespective of type of conveyor, a take-up device of mechanical type shall be used in flight conveyors. In a mechanical type take up, the tractive element is tensioned manually by means of a screw, rack and gear. The travel of the take up device shall be 50 to 100 mm more than the length of chain pitch/chain link so that the chain could be shortened by one chain pitch/chain link in case of excessive wear.

5.4.2 The take-up device is usually arranged at one of the turning devices of the conveyor in the section where the tractive element has the least tension. A pulley, sheave or sprocket is arranged not in the foremost position of the take-up device, but at a certain distance from it so as to ensure free joining of the tractive element.

5.5 Drive Head

The conveyor drive shall be consisting of the motor, spur-helical gear box and transmission chain wherever required. The motor power shall be taken such that the friction factor considered while calculating the power is 10 to 15 percent higher than the friction of the material on the trough. The transmission mechanism of the drive especially in medium and heavy type conveyor, should preferably be provided with a safeguard (shear pin) or torque limiting clutch to prevent damage to the conveyor on occasional over loading.

5.6 Trough/Conveyor Bed

If required by the purchaser, a closed trough may be constructed enclosing flight and chain. A trough shall be constructed from rolled steel sections having a maximum length of 3 to 4 m. The clearance between the trough and flights shall be 5 to 15 mm at each side. The trough shall be foot mounted and the trough supporting arrangements shall be made. Flanges at the joint of the troughs shall not be used for supporting.

5.7 Speed

Speed of flight conveyor is usually within the range of 0·16 to 0·4 m/s. Only in special cases it attains the values between 0·5 to 1 m/s. Conveyors with flights of width 200 to 320 mm have a speed of 0·1 to 1·0 m/s and those with flights of width 400 to 1 200 mm have speed of 0·5 to 0·63 m/s.

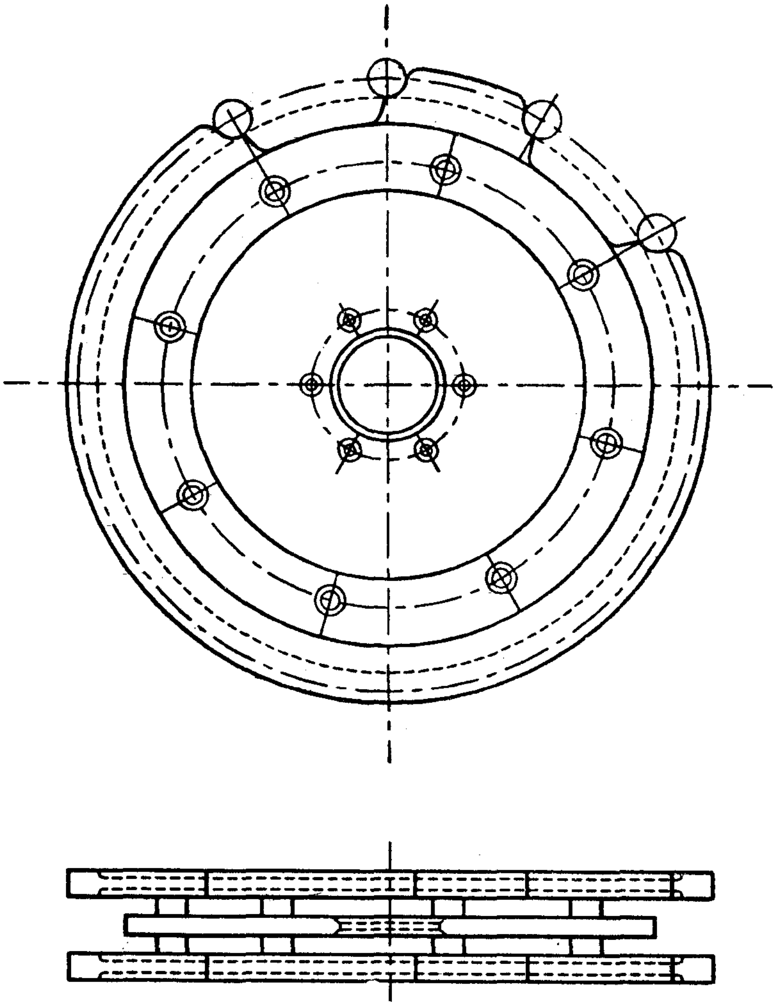


FIG. 13 TOOTH PROFILE OF SPROCKET FOR LAMINATED SLEEVE TYPE, ROLLER AND WHEEL CHAIN

6 SIZE OF LUMPS HANDLED

For convenience in choosing the size of conveyor required, Table 1 gives size of flights recommended to carry various lump sizes.

7 CAPACITY

7.1 The capacity of a flight conveyor in tonnes per hour is determined by the formula:

$$Q = 3\ 600\ A \rho v$$

where

A = the cross sectional area of the trough.

ρ = bulk density, and

v = speed of the conveyor in m/s.

7.1.1 Suitable derating factors shall be taken into consideration for inclined conveyors.

8 MARKING

Each flight conveyor shall be marked with the following information at suitable location:

a) Type,

b) Scraper (flight) style and size, and

c) Any other information required by the purchaser.

Table 1 Size of Lumps Handled

(*Clause* 6)

All dimensions in millimetres.

Style of Flights				Size of Lumps Handled			
A, B1 and B2 (for Carrying One Way)		C and D (for Carrying Two Way)		Flights on Single Strand of Chain		Flights on Two Strands of Chain	
Length	Width	Length	Width	Maximum	Average	Maximum	Average
300	100	300	200	75	40	90	45
300	150	300	300	90	45	100	50
375	150	375	300	115	65	125	75
450	150	450	300	125	70	150	150
375	200	375	400	115	65	200	100
450	200	450	400	—	—	200	100
600	200	600	400	—	—	250	150
600	250	600	500	—	—	300	200
750	250	750	500	—	—	350	250

NOTE — Flights shall be spaced at 400 mm to 600 mm for single strand and 600 mm to 900 mm for double strand chains.

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Amendments Issued Since Publication

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